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NAKSHATRA BASED RAINFALL ANALYSIS AND ITS IMPACT ON CROPS DURING MONSOON SEASON AT GKVK STATION

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ABSTRACT

Agricultural production in India mainly depends upon the monsoon rainfall. Its timely onset, spread over the country and distribution is important for Kharif crops. One of the traditional ways the farmers of India in general and its southern States in particular study rainfall patterns is through solar constellations called "Nakshatras". In the present paper, a brief analysis of rainfall based on Nakshatra periods is considered. The daily rainfall data for a period of 30 years from 1984 -2013 was collected from the agro-meteorological centre located at GKVK, Bengaluru.The analysis reveals that the periods from Punarvasu to Chitta which covers the monsoon period received good amount of rainfall during which crops like groundnut, sunflower, maize, finger millet and pulses like redgram, pigeon pea and chick pea can be taken up. Further, the trend in most of the Nakshatra periods was decreasing except Makha and Chitta. This indicates that over the years the total rainfall received during these periods were decreasing. There is a need to draw up a contingency plan to mitigate the proper planning of rainfed crops by farmers.

KEY WORDS –Nakshatra-wise rainfall, Constellation, Trend analysis of rainfall

INTRODUCTION

Agriculture is the backbone of Indian economy. Agricultural production mainly depends upon the occurrence of rainfall during the cropping season. The timely onset, its distribution and sufficient monsoon rainfall is the key for better agricultural production in the country which directly influences

rural poverty alleviation (Varshneya et al, 2011). There is considerable traditional knowledge of variability of rainfall patterns, since rainfed cultivation has been carried out for several centuries in India. The periods used by the farmers are however, not weeks or months but so-called "Nakshatras" which are 13- or 14-day periods based on calendar. The Nakshatras are constellations through which the sun passes in a year. There are 27 Nakshatras in a year viz., Purvashada, Uttarabadrapada, Shravana, Danista, Purvabhadra, Uttarabhadra, Revathi, Ashwini, Bharini, Krutika, Rohini, Mrugashira, Aridhra, Punarvasu, Pushya, Aslesha, Makha, Pubba, Uttara, Hastha, Chitta, Swathi, Vishaka, Anuradha, Jyeshta and Moola Nakshatras. Of these, the periods from Rohini to Chitta Nakshatras cover the monsoon season. The Nakshatra commences when the sun enters the specific constellation. Thus, the knowledge of the variability in these time units rather than weeks or months is considered important by the traditional farmers in Karnataka and other neighboring States. The appropriate time for farming operations can also be worked out in terms of these time periods (Subash et al., 2011). In order to translate the meteorological events into farmer's terminology, it is necessary to perform rainfall analysis in Nakshatra periods. Not many reviews are available but however, the following recent studies have been documented.

Narahari Rao et al. (2000) have suggested a crop model PNUTGRO based on Nakshatra periods in which an optimum sowing window for rainfed groundnut crop for Ananthpur region has been given. Gadgil and Rao (2000) have developed an approach for identifying appropriate strategies for rainfed regions based primarily on information and prediction of climate variability during Nakshatra periods. De et al. (2004) performed a time series analysis of rainfall on different Nakshatra periods covering Indian monsoon season. Bavadekar et al. (2008) have carried out Nakshatra-wise rainfall analysis for drought prone areas of Maharashtra. Chinnchorkar et al. (2013) on their study of rainfall variability at Anand in middle Gujarat region have concluded that rainfall during Punarvasu and Pushya is more assured than in other Nakshatras, while it is least assured during Makha and Pubba Nakshatras. Chabbra and Haris (2014) have compiled the indigenous knowledge related to climatic parameters, their forecasting during different time periods of a year (Nakshatras) based on experiences of the farmers and comparing indigenous knowledge with modern scientific analysis of weather data and their relationship with wheat and rabi maize yield in Patna, Bihar. Hazra et al. (2014) have proposed a mixture model of two distributions for each Nakshatra periods for the Eastern plateau of India. In the present study Nakshatra based rainfall analysis has been carried out in order to study its trend in each Nakshatra period as well as to study its impact on the crops during monsoon at GKVK station.

Methodology

The daily rainfall data recorded at Agro meteorology centre, UAS, GKVK, Bengaluru for 30 years from1984 to 2013 was used to analyze Nakshatra-wise rainfall distribution at GKVK station. Of the 27 Nakshatras, 11 Nakshatras from Rohini (May 25 to June 7) to Chitta (Oct.11-Oct.23) were considered for the analysis. The mean, standard deviation, coefficient of variation (CV%), minimum and maximum for Nakshatra-wise rainfall were calculated. The trend analysis of rainfall at each Nakshatra period has been carried out.

Results And Discussion
Characterization of Nakshatra-wise rainfall

Eleven Nakshatras were considered for analysis because this period coincides with the crop growing period of Kharif season. The descriptive statistics of Nakshatra-wise rainfall is presented in

Table.1. Rainfall was received in all Nakshatras and good amount was received from Aslesha (Aug.3-Aug.16) to Chitta (Oct.11-Oct.23). The maximum total rainfall of 370.8 mm occurred during Aslesha followed by 302.5 mm during Uttara. The mean rainfall was maximum during Hastha (102.8 mm) followed by Uttara (99.8 mm). The least rainfall was received during Aridhra (21.2 mm). The CV of rainfall was lowest during Hastha (65.9 per cent) followed by Pushya (72.9 per cent) while it was highest (125.8 per cent) during Mrugashira. The pre monsoon mean rainfall was highest during Rohini (64.3 mm) and lowest during Mrugashira (30.6mm). On the other hand, during post monsoon season the highest was in Hastha (102.8 mm) and the least during Chitta (83.7 mm).

Crop selection for rainfall in different Nakshatra periods

The Nakshatra-wise mean rainfall is shown in Fig.1. The figure shows that during Rohini Nakshatra a good amount of rainfall was received. This period can be utilized for sowing groundnut and red gram. Mrugashira and Aridhra Nakshatras received less rainfall during which one can take up crops like finger millet, sunflower, pigeon pea and groundnut. The period Rohini to Uttara received good rainfall which is suitable for finger millet, sunflower, maize, and pulses like red gram, pigeon pea, chick pea.

Table 1: Descriptive Statistics for Nakshatra-wise Rainfall (mm) at GKVK Station from 1984-2013

Season	Nakshatra	Period	Mean	SD	CV(%)	Minimum	Maximum
Pre-monsoon	Rohini	May.25-Jun.7	64.3	49.4	76.8	0.0	163.3
	Mrugashira	Jun.8-Jun.21	30.6	38.5	125.8	0.0	149.6
Monsoon	Aridhra	Jun.22-Jul.5	21.2	16.4	77.4	0.0	58.0
	Punarvasu	Jul.6-Jul.19	48.5	42.5	87.6	0.8	183.2
	Pushya	Jul.20-Aug.2	53.9	39.3	72.9	9.6	154.4
	Aslesha	Aug.3-Aug.16	67.4	72.6	107.7	6.0	370.8
	Makha	Aug.17-Aug.30	68.1	58.8	86.3	1.4	204.2
	Pubba	Aug.31-Sep.12	60.4	51.3	84.9	3.6	170.0
	Uttara	Sep.13-Sep.26	99.8	84.6	84.8	0.0	302.6
Post-monsoon	Hastha	Sep.27-Oct.10	102.8	67.7	65.9	6.4	275.4
	Chitta	Oct.11-Oct.23	83.7	79.5	95.0	0.0	286.8

Highest rainfall and Trend analysis of rainfall during Nakshatra periods

The highest rainfall during Nakshatra periods are presented in Table 2. The rainfall during Nakshatra periods ranged from 58.0 mm to 370.8 mm. Aslesha Nakshatra received the maximum rainfall of 370.8 mm during 1997 followed by Uttara Nakshatra of 302.6 mm. The low rainfall of 58.0 mm was recorded for Aridhra during 1992. The trend equations fitted for each of the Nakshatra periods reveal that all of them showed decreasing trend over the time period except for Makha and Chitta Nakshatras where the trend showed an increasing pattern. The fitted line and its equation are depicted in Fig. 2.
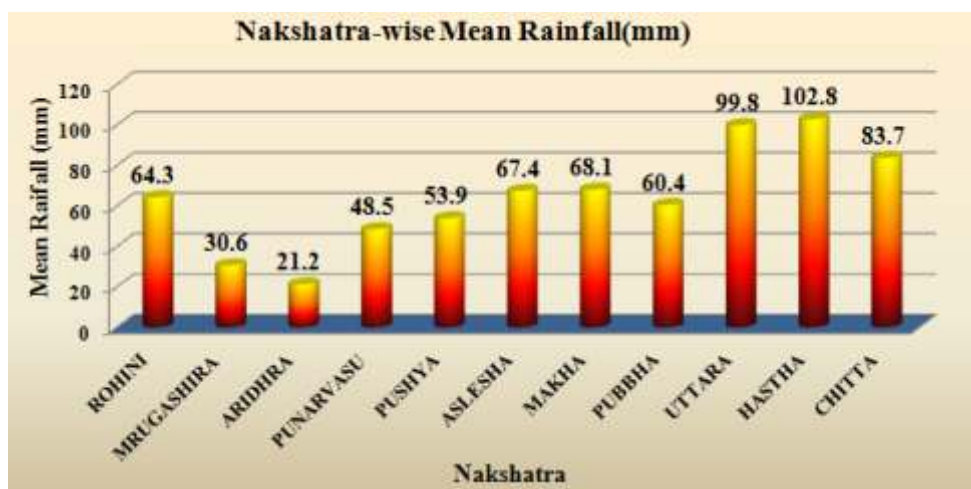
Fig.1: Nakshatra-wise mean rainfall (mm) at GKVK station from 1984-2013.

Table 2: Nakshatra-wise highest Rainfall (mm) and its trend equations

Season	Nakshatra	Period	Highest Rainfall		Trend equation
			Amount (mm)	Year	
Pre-monsoon	Rohini	May.25-Jun.7	163.3	1991	Y = 1405.0 – 0.670X
	Mrugashira	Jun.8-Jun.21	149.6	1996	Y = 608.8 – 0.289X
Monsoon	Aridhra	Jun.22-Jul.5	58.0	1992	Y = 362.5 – 0.170X
	Punarvasu	Jul.6-Jul.19	183.2	1988	Y = 457.6 – 0.204X
	Pushya	Jul.20-Aug.2	154.4	2007	Y = 115.9 – 0.031X
	Aslesha	Aug.3-Aug.16	370.8	1997	Y = 471.0 – 0.202X
	Makha	Aug.17-Aug.30	204.2	2008	Y = - 3688.0 + 1.879X
	Pubba	Aug.31-Sep.12	170.0	1993	Y = 1265.0 - 0.603X
	Uttara	Sep.13-Sep.26	302.6	2001	Y = 3912.0 – 1.907X
Post-monsoon	Hastha	Sep.27-Oct.10	275.4	1997	Y = 686.3 – 3.382X
	Chitta	Oct.11-Oct.23	286.8	1999	Y = - 135.5 + 0.109X

The pre monsoon period like Rohini, received an average of 64.3 mm rainfall during which land preparation and sowing of crops can be taken up while the period from Punarvasu to Chitta Nakshatras are suited for Kharif crops like finger millet, groundnut and sunflower.
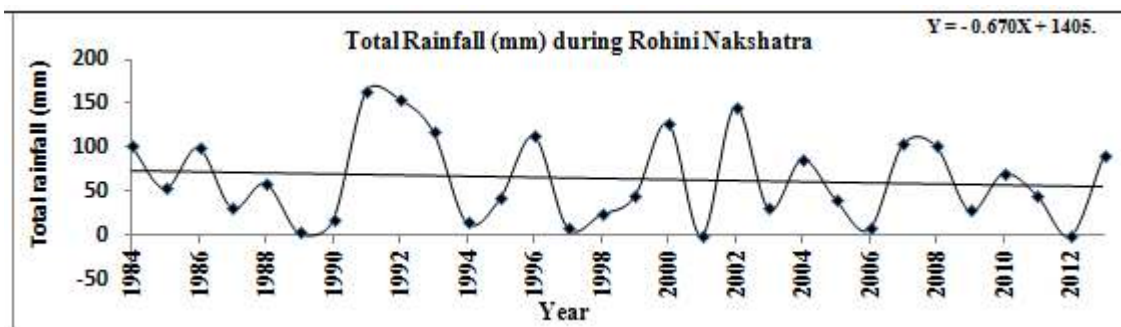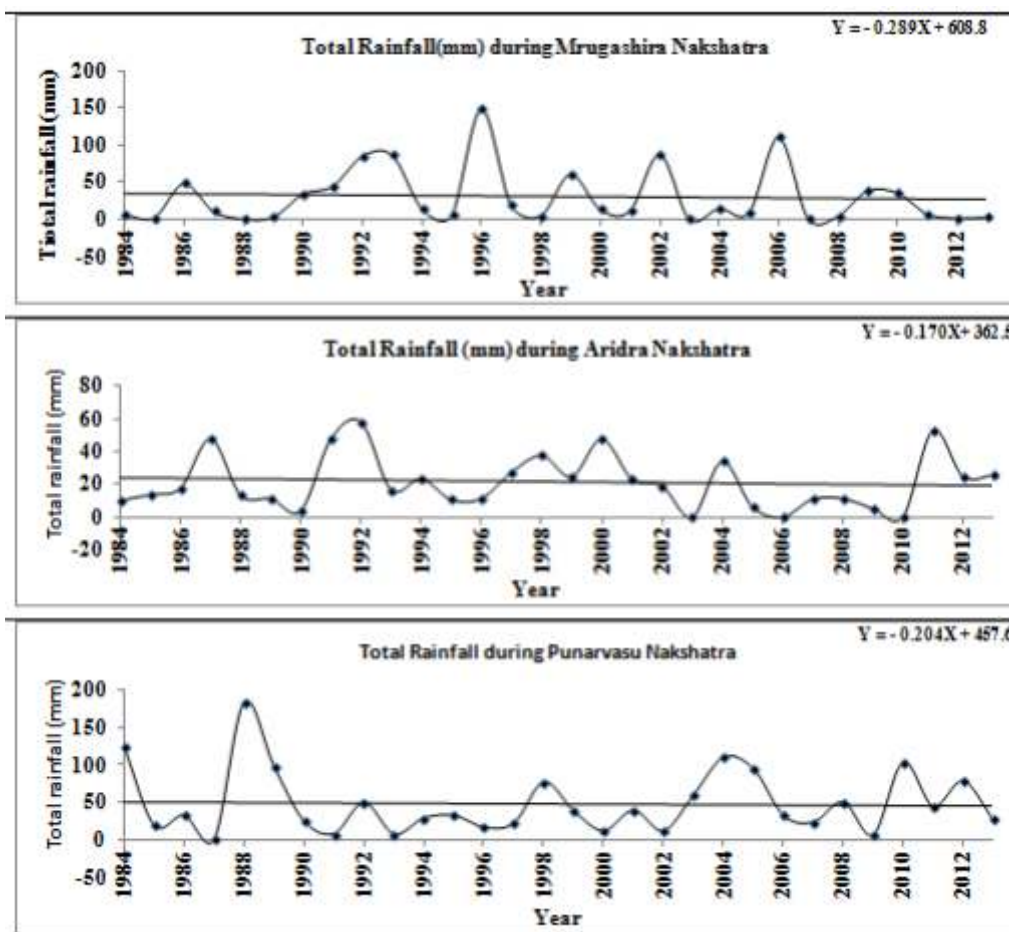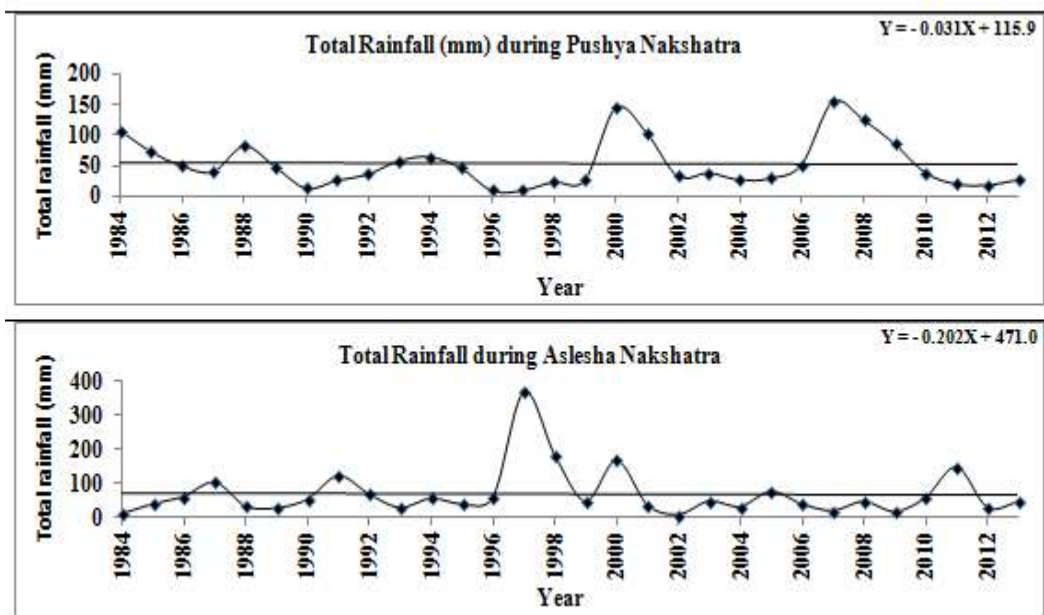
Fig.2: Nakshatra-wise Trend analysis of rainfall for the period from 1984 to 2013.
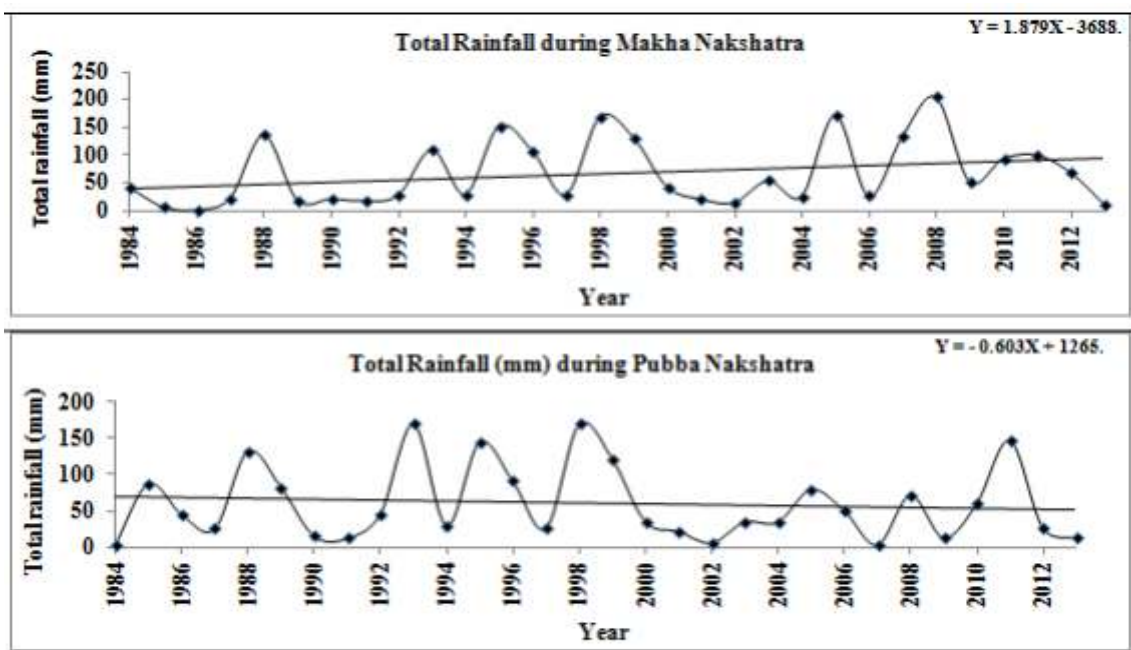
Fig.2: Nakshatra-wise Trend analysis of rainfall for the period from 1984 to 2013(Contd.)
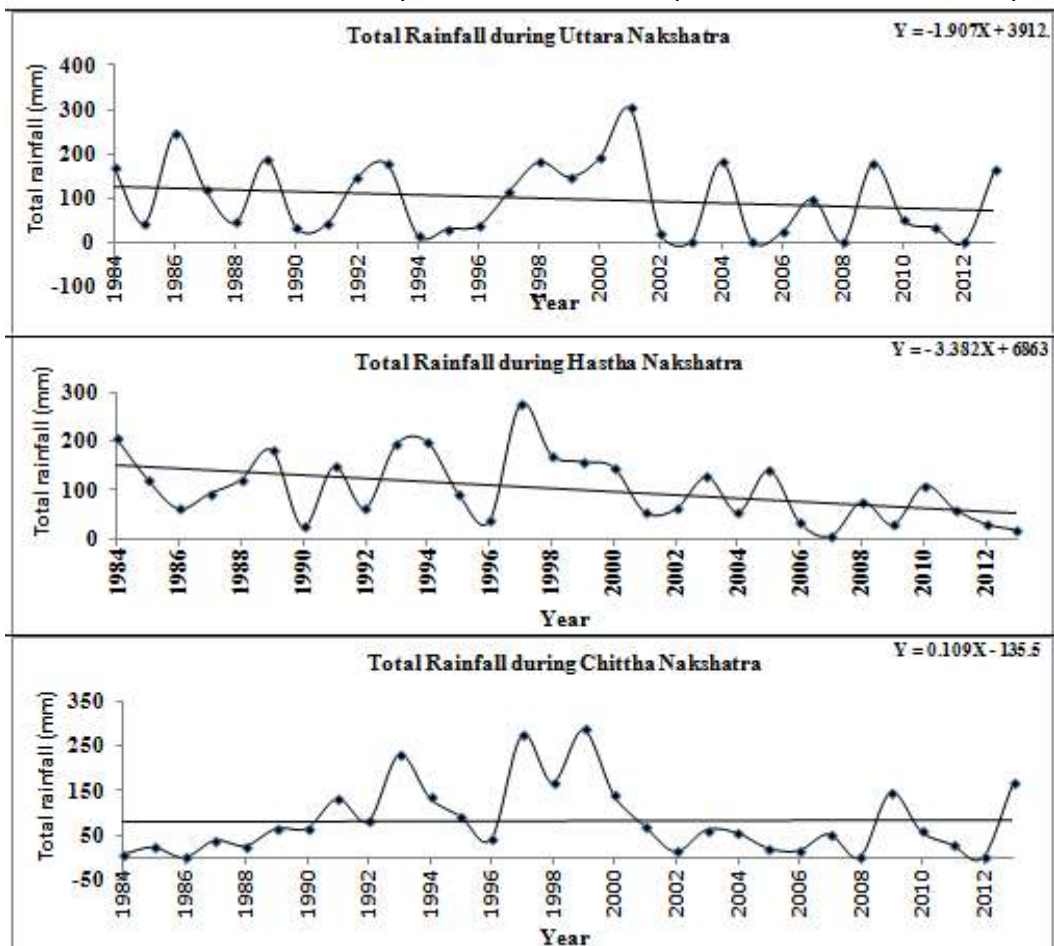

Fig.2: Nakshatra-wise Trend analysis of rainfall for the period from 1984 to 2013 (Contd.)

CONCLUSION

From the above analysis it reveals that the periods from Punarvasu to Chitta which covers the monsoon period received good amount of rainfall during which crops like groundnut, sunflower, maize, finger millet and pulses like redgram, pigeon pea and chick pea can be taken up. Further, in most of the Nakshatra periods the trend was decreasing except Makha and Chitta. This indicates that over the years the total rainfall received during these periods were decreasing. Hence, there is a need to draw up contingent planning of rainfed crops by farmers during these periods.

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